SAVOIR
space avionics open interface architecture

Integrated Modular Avionics: SAVOIR-IMA status and progress

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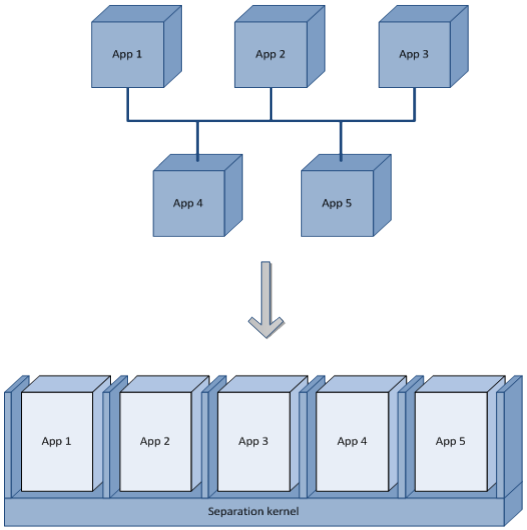
Outline

- TSP
- IMA Roadmap
- SAVOIR-IMA
  - Who are we?
  - How do we link to other working groups?
  - Activities and schedule
  - Inputs and outputs
  - Status

Integrated Modular Avionics

- The aviation domain has been working since the early 1990's on integration of different software applications onto the same hardware
  → **Integrated Modular Avionics (IMA)**
- A key enabler for this is guaranteed separation and non-interference
  - **Partitioning** provided by partitioning kernel
- Benefits
  - Savings on mass, volume and power
  - Parallel development
  - Incremental V&V
  - Fault containment
  - Improved SW maintenance
- Supported by ARINC standards (A651, A653, DO-297)
- Used by Boeing (777 & 787) and Airbus (A380)

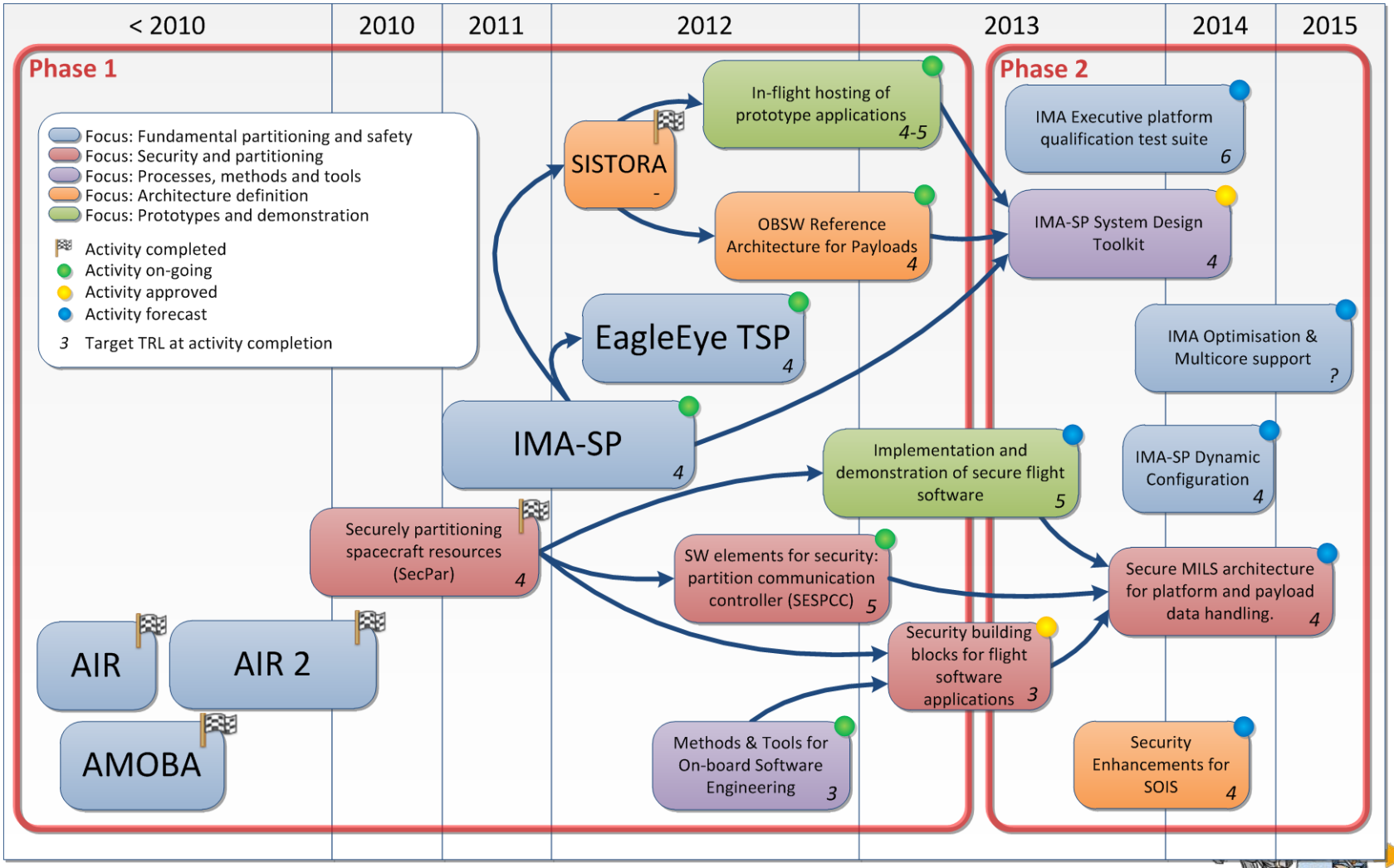


Time and Space Partitioning (TSP)

- At the core of IMA, partitioning ensures proper separation and non-interference across software functions
  - Partitioning kernel
- Time
  - Each partition is assigned a time slot in which the software is allowed to execute
- Space
  - Each partition is assigned a special area in memory where it may access contents

- Violations during executions will be detected and the failing partition is stopped, ensuring that other partitions remain unaffected

IMA Roadmap



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Members

Name	Company
Ana Isabel Rodríguez Rodríguez	GMV
Alain Rossignol	Astrium
Aldo Sala	Intecs
Christian Spinelli	ThalesAleniaSpace
Gerald Garcia	ThalesAleniaSpace
Jacques Busseuil	ThalesAleniaSpace
Massimo Ferraguto	SSF
Massimo Molteni	Intecs
Massimo Tipaldi	OHB
Patrik Sandin	RUAG Space
Paul Arberet	CNES
Poul Hougaard	Terma
Stuart Fowell	SciSys
Thierry Duhamel	Astrium
Andreas Jung	ESA/ESTEC
Fabio van Hattem	ESA/ESTEC
Giorgio Magistrati	ESA/ESTEC
James Windsor	ESA/ESTEC
Maria Hernek	ESA/ESTEC
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Liaisons and interfaces

SAVOIR
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SAVOIRFAIRE
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Andreas Jung

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Maria Hernek

Stuart Fowell

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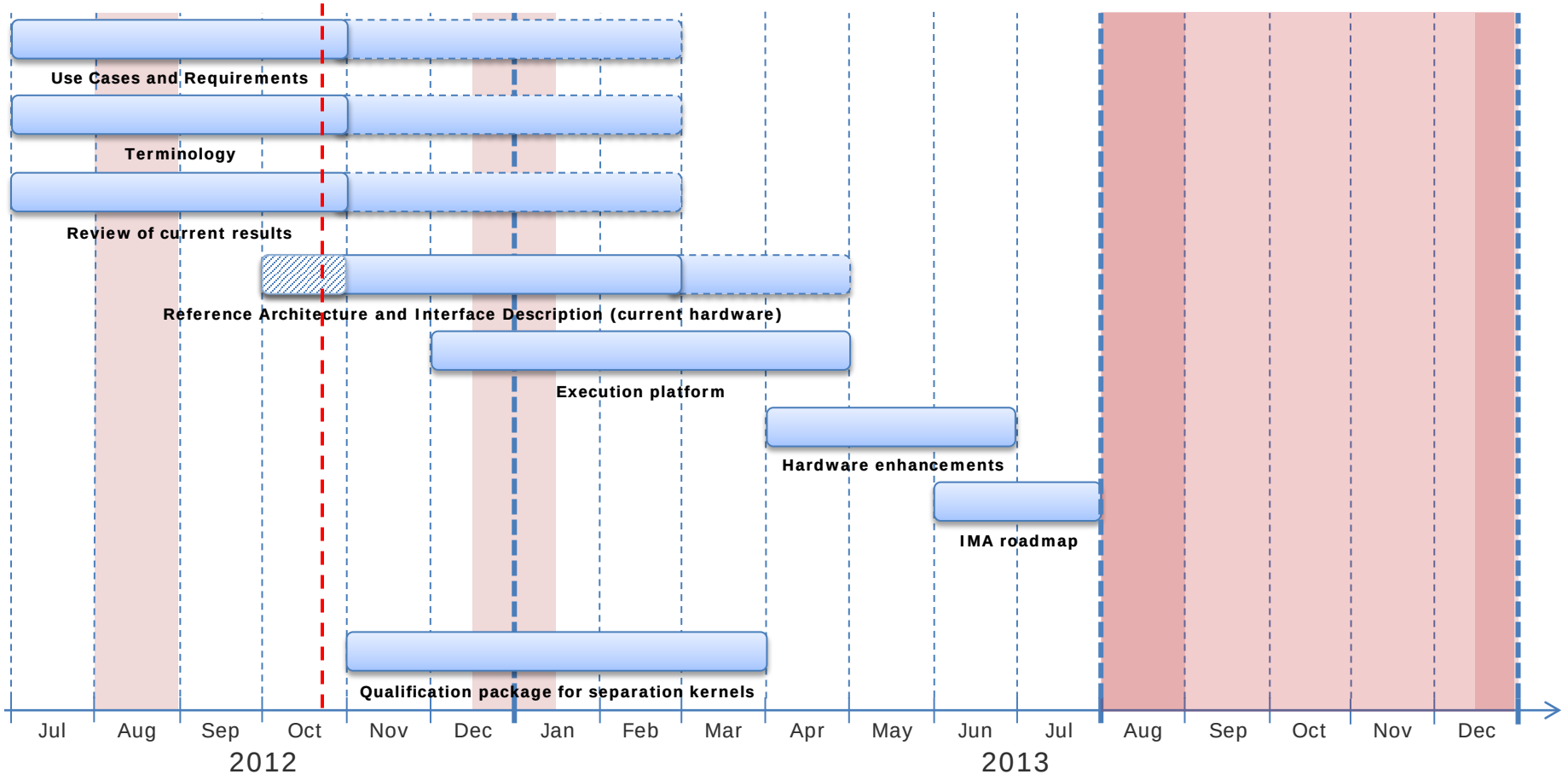
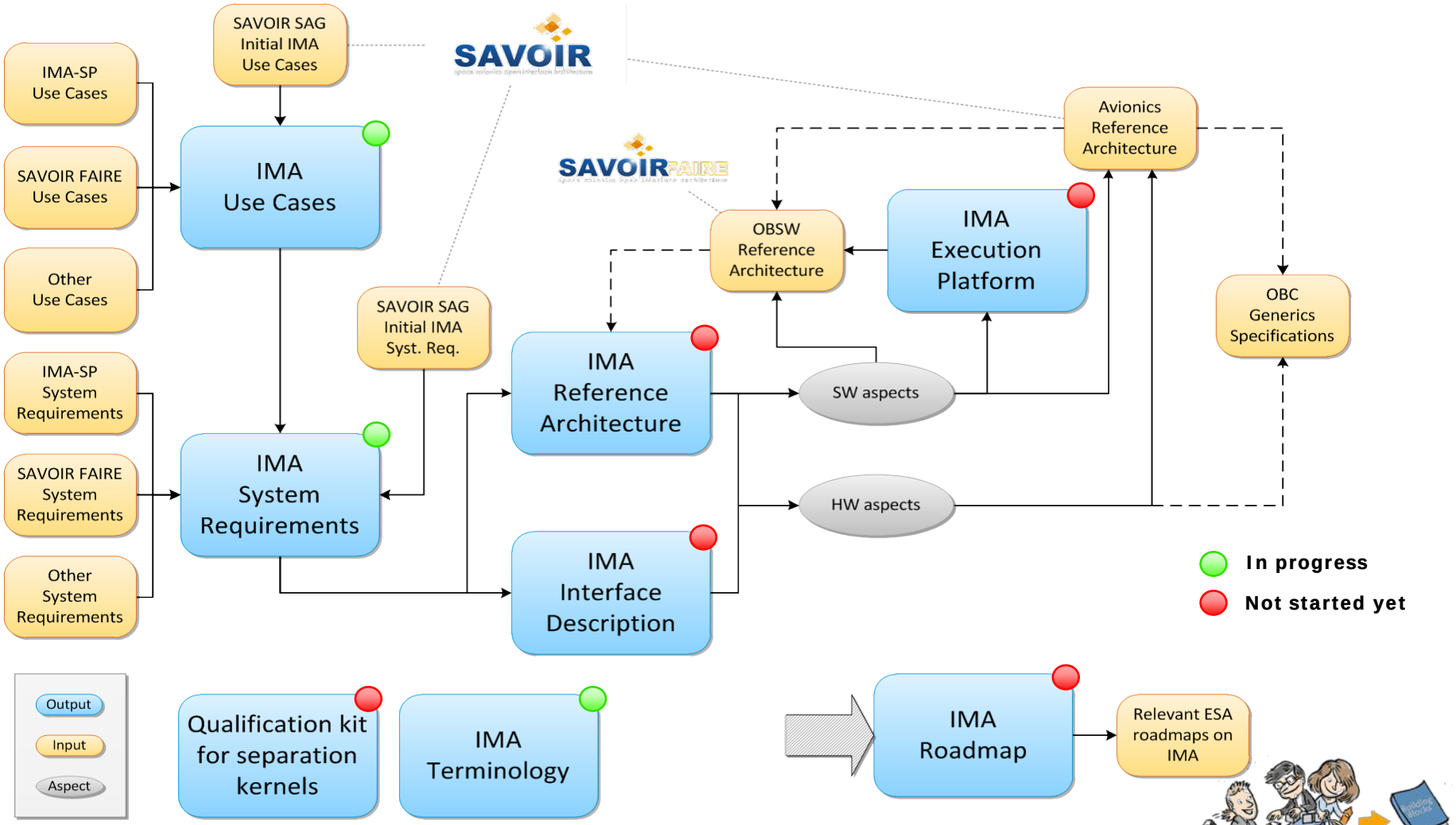
Hardware reference and standardisation

Activities and overall schedule



Inputs and outputs



Updating TSP use cases and requirements

- Objective
  - Revisit TSP WG results from 2007 and update with any new insights and experiences gained from IMA related activities completed since then. Primarily, IMA-SP results are considered as new input.
  - Set priorities to use cases, features and requirements.
- Purpose
  - Ensure that the needs and requirements that initiated the work on introducing IMA to spacecraft avionics are still valid.
  - Ensure that new findings and experiences are taken into account when moving forward with IMA for spacecraft avionics.
  - Ensure that SAVOIR IMA members all agree on the use cases and requirements.

Avionics Time And Space Partitioning User Needs

Benefits

Impact

Use Cases

Features

Requirements

1. Integrating DMS, AOCS and other CFS functions on one OBC
2. Software development using multiple teams
3. OBCP development and management
4. Payload software development and integration in OBSW
5. Mission specific flight software
6. Guaranteeing on-board security in dual-use missions

1. Shared libraries
2. Publishing of on-board data through the on-board parameter database functionality
3. Access to CPU margin for sporadic and intensive computations
4. Guaranteed/assured access to I/O bandwidth
5. Execution of the same application code
6. Maintainability
7. Evolution
8. Flexibility of the design w.r.t. various functional modes

- 17 high-level user requirements

Procedure for updating User Needs

- Phase 1: Revisit the Benefits, Use Cases, Impact, and Features
  - Are they still valid?
  - Are they properly described?
  - How should they be prioritised?
  - Should anything be added?

November 2

- Phase 2: Revisit the high-level requirements and consolidate with IMA-SP results (where applicable).
- Phase 3: Review remaining TSP WG results
  - Differences between aeronautical and space domain
  - Implementation considerations
  - Ideas for evolving TSP

Current hardware definition

- Objective
  - Define the basic hardware features to be considered “current hardware”.
- Purpose
  - Ensure that current IMA activities target realistic hardware capabilities.
  - Ensure that results from current IMA activities can be applied in the near future.

Baseline HW perimeter

- OBC
  - Processor: LEON3-FT or LEON2-FT w/ MMU
    - SCOC3
    - UT699
    - COLE
  - Plus the following OBC spec functions:

OBC functions	
Safe Guard Memory	Essential TC
Reconfiguration	Mission Data Links
Telecommand	Cmd & Ctrl Links
Platform TM	On Board Time
Platform Data Storage	PIO

- SpW network: SMCS332SpW and SpW-10X router
- 1553 bus
- UART (for debugging)

Terminology

- Objective
  - Compile, consolidate and extend the terminologies provided within SAVOIR.
- Purpose
  - Ensure that relevant IMA terms and concepts are taken into account.
  - Ensure that a coherent language is used in discussions and documentation so as to avoid misunderstandings.

‼ **Note: There should really only be one common terminology within SAVOIR, so the work here should be reviewed by all SAVOIR working groups, and should apply to all SAVOIR working groups.**

Procedure for terminology definition

1. Compile terminologies from SAVOIR, SAVOIR FAIRE, COrDeT, IMA-SP
2. Identify terms with potential conflicts or need for consolidation
3. Review compilation and identified terms

4. Propose modifications
    - Combine terms
    - Add new terms
    - Remove terms
    - Rephrase definitions
5. Review modifications
6. If not ready, go to 4
    - Hopefully not more than 2-3 iterations

‼ **Note: This is closely coupled with the harmonisation of the reference architectures, and thus will go hand in hand with those efforts.**

SISTORA

Study on IMA Space – TSP in the OBSW Reference Architecture Context

- Initial study on how the OBSWRA and IMA-SP approaches could come together
  - Identifies a set of areas/topics for deeper analysis
  - Analyses overlap and potential conflicts
  - Proposes ways in which alignment can be achieved
- SAVOIR IMA WG has had the opportunity to review the results and provide feedback to the consortium
  - And was invited to the Mid-Term Review on September 11 and to the Final Review on October 9
- Final presentation in just a few minutes…
- Results are valuable input to definition of upcoming harmonization activities

Conclusions

- SAVOIR IMA has had a good start
- Getting TSP properly into the OBSW is a “hot topic” that spurs a lot of discussions (and must be allowed to do so)
- SISTORA set to be very valuable input to upcoming activities on harmonization of reference architectures

Contact

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